CLAIMS

What is claimed is:

1.   A method of simulating operation of a wireless communication network, the method comprising:

5   a) defining a set of base stations in the wireless communication network;

           b) defining a set of subscriber units;

           c) defining a set of subscriber types, each subscriber type being associated with an application and a desired data rate;

           d) assigning a subscriber type to each of the subscriber units;

10   e) for each subscriber unit, determining whether the subscriber unit can establish a communication link with a selected base station at a desired data rate;

           f) if the subscriber unit can not establish a communication link with a selected base station at the desired data rate, determining whether the subscriber unit can establish a communication link with the selected base station at a reduced data rate.

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2.   The method of claim 1 wherein the communication link is a reverse link channel.

3.   The method of claim 2 wherein determining whether the subscriber unit can establish a communication link with the selected base station at the desired data rate comprises:

20   a) determining the reverse link transmit power required to establish the reverse link channel at the desired peak data rate with the selected the base station;

b) determining if the required reverse link transmit power is greater than an available transmit power for the subscriber unit.

4.   The method of claim 3 wherein determining the reverse link transmit power required to establish the reverse link channel at the desired peak data rate with the selected the base station comprises:

a) computing a sensitivity for the selected base station based on the total received power at the selected base station;

b) determining the reverse link transmit power required to transmit a signal from the subscriber unit to the selected base station on the reverse link channel so as to arrive at the selected base station with power at least equal to the base station sensitivity.

5.   The method of claim 4 wherein determining the required reverse link transmit power further comprises determining a propagation loss from the subscriber unit to the selected base station and computing the reverse link transmit power based on the propagation loss and the base station sensitivity.

6.   The method of claim 5 wherein computing the sensitivity of the selected base station comprises:

a) assigning a subset of the subscriber units to the selected base station;

b) determining, for each base station, the total received power from a corresponding subset of subscriber units.

7.   The method of claim 6 wherein assigning a subset of the subscriber units to the selected base station comprises determining, for each subscriber unit, at least one selected base station for which the subscriber unit can establish a reverse link channel with minimal reverse link

5   transmit power.

8.   The method of claim 4 wherein the simulation is performed over multiple iterations and wherein the base station sensitivity and reverse link transmit powers for the subscriber units are recalculated in each iteration.

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9.   The method of claim 4 wherein the total received power at each base station is determined, in each iteration after the first iteration, from the required reverse link transmit powers for the subscriber units computed in the prior iteration.

15   10.   The method of claim 1 wherein defining a set of subscriber units comprises:

a) generating an initial set of subscriber units;

b) for each subscriber unit in the initial set of subscriber units, determining whether the subscriber unit can establish a communication link with at least one base station;

c) eliminating subscriber units from the initial set of subscriber units that cannot

20   establish a communication link with at least one base station.

11.   The method of claim 1 wherein the communication link is a forward link channel.

12.   The method of claim 11 wherein determining whether the subscriber unit can establish a

forward link channel with a selected base station at the desired data rate comprises:

a) determining an available transmit power for the selected base station;

5   b) determining the forward link transmit power required to establish the forward link

channel between the subscriber unit and the selected base station; and

c) comparing the required forward link transmit power with the available forward link

transmit power.

10   13.   The method of claim 12 wherein determining the available transmit power for the

selected base station comprises:

a) determining whether the subscriber type of the subscriber unit;

b) determining the available transmit power based on the subscriber type of the

subscriber unit.

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14.   The method of claim 13 wherein determining the available transmit power based on the

subscriber type of the subscriber unit. comprises:

a) determining whether the subscriber unit is a voice user or a data user based on the

subscriber type of the subscriber unit;

20   b) if the subscriber unit is a voice user, determining the available transmit power for

voice users; and

c) if the subscriber unit is a data user, determining the available transmit power for data users.

15. The method of claim 1 further comprising comparing the reduced data rate to a minimum data rate for the application associated with the subscriber unit to determine whether the reduced data rate is acceptable for the application.

16.   A method of simulating operation of a wireless communication network, the method comprising:

a) defining a set of base stations in the wireless communication network;

b) defining a set of subscriber units;

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c) defining a set of subscriber types, each the subscriber type being associated with an application and a desired peak data rate;

d) assigning a subscriber type to each of the subscriber units;

e) for each subscriber unit, determining the reverse link transmit power needed to acquire service with one or more selected base stations at the desired peak data rate;

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f) if the reverse link transmit power needed to acquire service with the selected base stations at the desired peak data rate is greater than the maximum transmit power of the subscriber unit, determining whether the subscriber unit has sufficient power to acquire service with the selected base stations at a reduced peak data rate.

15   17.   The method of claim 16 wherein determining the reverse link transmit power needed to acquire service with one or more base stations at the desired peak data rate comprises:

a) computing a sensitivity for each of the selected base stations based on the total received power at the selected base stations;

b) determining the reverse link transmit power needed to transmit a signal from the

20   subscriber unit to the selected base stations so as to arrive at the base station with power at least equal to the base station sensitivity.

18.   The method of claim 17 wherein determining the reverse link transmit power further comprises determining a propagation loss from the subscriber unit to the selected base stations and computing the reverse link transmit power based on the propagation loss and the base station sensitivity.

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19.   The method of claim 18 wherein computing the sensitivity of a selected base station comprises:

a) assigning a subset of the subscriber units to the selected base stations;

b) determining, for each selected base station, the total received power from a corresponding subset of subscriber units.

20.   The method of claim 19 wherein assigning a subset of the subscriber units to the selected base stations comprises determining, for each subscriber unit, at least one selected base station for which the subscriber unit can establish a reverse link channel with minimal reverse link transmit power.

21.   The method of claim 17 wherein the simulation is performed over multiple iterations and wherein the base station sensitivity and reverse link transmit powers for the subscriber units is recalculated in each iteration.

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22.   The method of claim 21 wherein a new subscriber distribution for said set of subscriber units is used for each iteration, and wherein the total received power at each base station is determined in each iteration is based on the new subscriber distribution.

23.   The method of claim 17 further comprising comparing the reduced data rate to a minimum data rate for the application associated with the subscriber unit to determine whether the reduced peak data rate is acceptable for the application.

5   24.   The method of claim 17 wherein defining a set of subscriber units comprises:

a) generating an initial set of subscriber units;

b) for each subscriber unit in the initial set of subscriber units, determining whether the subscriber unit can transmit an acceptable signal to at least one base station on the reverse fundamental channel and the reverse pilot channel;

10   c) eliminating subscriber units from the initial set of subscriber units that cannot transmit an acceptable signal to at least one base station on the reverse fundamental channel and the reverse pilot channel.

25.   A method of simulating operation of a wireless communication network, the method

comprising:

a) defining a set of base stations in the wireless communication network;

b) defining a set of subscriber units;

5   c) defining a set of subscriber types, each the subscriber type being associated with an

application and a desired data rate;

d) assigning a subscriber type to each of the subscriber units;

e) for each subscriber unit, determining whether the subscriber unit can establish a

forward link channel with a selected base station at the desired data rate;

10   f) if the subscriber unit can not establish a forward link channel link with the selected

base station at the desired data rate, determining whether the subscriber unit can

establish a forward link channel with the selected base station at a reduced data rate.

26.   The method of claim 25 wherein determining whether the subscriber unit can establish a

15 forward link channel with a selected base station at the desired data rate comprises:

a) determining the available transmit power for the selected base station;

b) determining the forward link transmit power required to establish a forward link

channel between the subscriber unit and the selected base station; and

c) comparing the required forward link transmit power with the available transmit power.

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27.   The method of claim 26 wherein determining the available transmit power for the

selected base station comprises:

a) determining whether the subscriber type of the subscriber unit;

b) determining the available transmit power based on the subscriber type of the subscriber unit.

5   28.   The method of claim 27 wherein determining the available transmit power based on the subscriber type of the subscriber unit. comprises:

a) determining whether the subscriber unit is a voice user or a data user based on the subscriber type of the subscriber unit;

b) if the subscriber unit is a voice user, determining the available transmit power for voice users; and

c) if the subscriber unit is a data user, determining the available transmit power for data users.

29.   The method of claim 25 further comprising comparing the reduced data rate to a minimum data rate for the application associated with the subscriber unit and denying service on the forward link channel if the reduced peak data rate is less than the minimum data rate for the application.

30. A computer readable media storing program code for simulating operation of a wireless

communication network, the computer readable media comprising:

a) program code for defining a set of base stations in the wireless communication

5   network;

b) program code for defining a set of subscriber units;

c) program code for defining a set of subscriber types, each the subscriber type being

associated with an application and a desired data rate;

d) program code for assigning a subscriber type to each of the subscriber units;

10   e) program code for determining whether the subscriber unit can establish a

communication link with a selected base station at a desired data rate; and

f) program code for determining whether the subscriber unit can establish a

communication link with the selected base station at a reduced data rate.

15 31. The computer readable media of claim 30 wherein the program code for determining

whether the subscriber unit can establish a communication link with the selected base station at

the desired data rate comprises:

a) program code for determining the reverse link transmit power required to establish

the reverse link channel at the desired peak data rate with the selected the base station;

20   b) program code for determining if the required reverse link transmit power is greater

than an available transmit power for the subscriber unit.

32.   The computer readable media of claim 31 wherein the program code for determining the

reverse link transmit power required to establish the reverse link channel at the desired peak

data rate with the selected the base station comprises:

a) program code for computing a sensitivity for the selected base station based on the

5   total received power at the selected base station;

b) program code for determining the reverse link transmit power required to transmit a

signal from the subscriber unit to the selected base station on the reverse link channel

so as to arrive at the selected base station with power at least equal to the base station

sensitivity.

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33.   The computer readable media of claim 32 wherein the program code for determining the

required reverse link transmit power further determines a propagation loss from the subscriber

unit to the selected base station and computes the reverse link transmit power based on the

propagation loss and the base station sensitivity.

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34.   The computer readable media of claim 33 wherein the program code for computing the

sensitivity of the selected base station assigns a subset of the subscriber units to the selected

base station, and determines, for each base station, the total received power from a

corresponding subset of subscriber units.

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35.   The computer readable media of claim 34 wherein the program code for assigning a

subset of the subscriber units to the selected base station determines, for each subscriber unit,

at least one selected base station for which the subscriber unit can establish a reverse link channel with minimal reverse link transmit power.

36.   The computer readable media of claim 32 wherein the program code executes over
5   multiple iterations and wherein the base station sensitivity and reverse link transmit powers for the subscriber units are recalculated in each iteration.

37.   The computer readable media of claim 32 wherein a new subscriber distribution for said set of subscriber units is used for each iteration, and wherein the program code determines the
10   total received power at each base station in each iteration is based on the new subscriber distribution.

38.   The computer readable media of claim 30 wherein the program code for defining a set of subscriber units comprises:

15   a) program code for generating an initial set of subscriber units;

     b) program code for determining whether each subscriber unit can establish a communication link with at least one base station;

     c) program code for eliminating subscriber units from the initial set of subscriber units that cannot establish a communication link with at least one base station.

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39.   The computer readable media of claim 30 wherein the program code for determining

whether the subscriber unit can establish a forward link channel with a selected base station at

the desired data rate comprises:

a) program code for determining an available transmit power for the selected base

station;

b) program code for determining the forward link transmit power required to establish

the forward link channel between the subscriber unit and the selected base station; and

c) program code for comparing the required forward link transmit power with the

available forward link transmit power.

40.   The computer readable media of claim 39 wherein the program code for determining the

available transmit power for the selected base station comprises:

a) program code for determining whether the subscriber type of the subscriber unit;

b) program code for determining the available transmit power based on the subscriber

type of the subscriber unit.

41.   The computer readable media of claim 40 wherein the program code for determining the

available transmit power based on the subscriber type of the subscriber unit. comprises:

a) program code for determining whether the subscriber unit is a voice user or a data

user based on the subscriber type of the subscriber unit;

b) program code for determining the available transmit power for voice users; and

c) program code for determining the available transmit power for data users.

42.   The computer readable media of claim 30 further comprising program code for

comparing the reduced data rate to a minimum data rate for the application associated with the

subscriber unit to determine whether the reduced data rate is acceptable for the application.

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43.   A method of selecting a radio configuration of a subscriber unit running a specific

application from a set of possible radio configurations for use in a computer simulation of a

CDMA network, said method comprising:

        determining one or more required radio channels needed to support the application at a

                desired data rate;

        determining a set of supported radio configurations for the application from the set of

                possible radio configurations;

        determining a desired error rate;

        determining an energy ratio for each required radio channel for each supported radio

                configuration based on the desired error rate; and

        selecting a radio configuration from the set of supported radio configurations having a

                minimum combined energy ratio for all the required channels.

44.   The method of claim 43 wherein determining an energy ratio for each supported radio

configuration for each required channel based on the desired error rate comprises determining

the energy ratios for all required forward link channels and for all required reverse link channels.

45.   The method of claim 44 wherein selecting a radio configuration from the set of supported

radio configurations comprises;

selecting a radio configuration for forward link communications; and

selecting a radio configuration for reverse link communications

46.   The method of claim 45 wherein the radio configuration for forward link communications

5   and reverse link communications are selected independently.

47.   The method of claim 43 wherein said one or more required channels includes at least

one fundamental channel.

10   48.   The method of claim 43 wherein said energy ratio for the fundamental channel

comprises a ratio of the signal energy per bit to noise energy.

49   The method of claim 46 wherein said one or more required channels includes at least

one supplemental channel.

15   50.   The method of claim 43 wherein said energy ratio for the fundamental channel

comprises a ratio of the signal energy per bit to interference energy.

51.   The method of claim 43 wherein determining a desired error rate comprises determining

20   a desired frame error rate.

52.   The method of claim 43 wherein determining an energy ratio for each required radio

channel for each supported radio configuration based on the desired error rate comprises:

storing a plurality of performance curves representing a relationship between said

energy ratio and said error rate in a memory, each performance curve

corresponding to a particular radio channel; and

selecting a corresponding performance curve for a radio channel; and

5   using the performance curve to determine the energy ratio for the selected radio

channel.

53.   A computer readable media storing program code for simulation operation of a

communications network, said program code stored in said computer readable media

10   comprising:

code for determining one or more required radio channels needed to support the

application at a desired data rate;

code for determining a set of supported radio configurations for the application from the

set of possible radio configurations;

15   code for determining a desired error rate;

code determining an energy ratio for each required radio channel for each supported

radio configuration based on the desired error rate; and

code for selecting a radio configuration from the set of supported radio configurations

having a minimum combined energy ratio for all the required channels.

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54.   The computer readable media of claim 53 wherein said program code for determining

said energy ratios computes said energy ratios for all required forward link channels and for all

required reverse link channels.

55.   The computer readable media of claim 54 wherein said program code for selecting a radio configuration from the set of supported radio configurations independently selects a radio configuration for forward link communications and reverse link communications.

5   56.   The computer readable media of claim 53 further comprising a plurality of performance curves a relationship between said energy ratio and said error rate stored therein, each performance curve corresponding to a particular radio channel.

57.   The computer readable media of claim 56 wherein said program code for determining an
10   energy ratio for each required radio channel selects a corresponding performance curve for a radio channel, and uses the performance curve to determine the energy ratio for the selected radio channel.